

REMARKS

Claims 1-36 are pending in this application, all of which have been finally rejected.

Claims 1, 9, 10, 24, 32, 33 and 34 are amended herein.

Amendments to the Specification

Amendments to the specification are made herein to correct some clerical errors. It is respectfully submitted that no new matter is added. Entry of the amendments is respectfully requested.

Amendments to the Claims:

Amendments are made to claim 1 to further specify that the isomerization process is a double-bond isomerization process and that the conversion loss per hour is measured by the isomerization of 1-butene to 2-butene under “the isomerization conditions”, as would be readily understood by one skilled in the art. That the isomerization process is a double bond isomerization process is implicit from the recitations of dependent claim 8. Addition of the recitation “under the isomerization conditions” is for further clarification to obviate any problem under 35 U.S.C. §112. It is respectfully submitted that neither of these amendments to claim 1 raises a new issue which would require another search. Entry of these amendments is respectfully requested.

Amendments are made to claims 9, 10, 24, 32, 33 and 34 to correct clerical errors. It is respectfully submitted that no new issues are raised. Entry of this amendment is respectfully requested.

The Rejections under 35 U.S.C. §112

Claims 1-23 are rejected under 35 U.S.C. §112, first paragraph as allegedly being unsupported by the specification. In particular, the office action asserts as follows:

Regarding claims 1 and step d of claim 20, applicants claim an unspecified amount activity-affecting impurity which is decided by “conversion loss per hour” of the isomerization reaction, namely the “isomerization of 1-butene to 2-butene”. However, it is well-known that a chemical reaction is depended on selected parameters such as temperature, pressure, catalyst, conversion, purity of the feed and so on. In other words, a chemical reaction must be defined by these parameters. Similarly, the activity of the catalyst also depends on these parameters of a chemical reaction. In the claims, applicants do not claim what the temperature, pressure, conversion, the purity of the feed and so on of the isomerization, namely the isomerization of 1-butene to 2-butene, are. One having ordinary skill in the art cannot identify from the claimed process which isomerization process under a specific condition of temperature, pressure, conversion, namely isomerization of 1-butene to 2-butene is used as the measurement unit of the conversion loss. Therefore, claims lack enablement.

This rejection is respectfully traversed.

35 U.S.C. §112, first paragraph states as follows in relevant part:

The specification shall contain a written description of the invention and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

As can be seen, 35 U.S.C. §112, first paragraph is directed to the sufficiency of the specification in supporting the claims. However, the rejection is based on the allegation that “. . . applicants do not claim what the temperature, pressure, conversion, the purity of the feed and so on of the isomerization, namely the isomerization of 1-butene to 2-butene, are.”

Claims are to be construed in the light of the specification. *Slimfold Manufacturing Co. Inc. v. Kinkead Industries Inc.*, 1 USPQ2d 1563, 1566 (Fed. Cir. 1987); *ACS Hospital Systems, Inc. v. Montefiore Hospital et al.*, 221 USPQ 929, 932 (Fed. Cir. 1984). In the present

application the recitation of “conversion loss per hour as measured by the isomerization of 1-butene to 2-butene” is adequately supported by the specification. For example, at page 7 of the specification, lines 20 to 23, an olefin isomerization temperature range of 300° to 600°C is disclosed. The Office Action argues that other parameters such as pressure, space velocity must be disclosed. However, olefin isomerization condition of pressure, temperature and space velocity are disclosed at page 15, lines 18-20, page 16, lines 9-10, page 17, line 1 and lines 18-20, and in Table 3 on page 18.

One skilled in art would not find the recitation of “conversion loss per hour as measured by the isomerization of 1-butene to 2-butene” to be unsupported by the specification when examples of suitable isomerization conditions are disclosed in the specification. The examples specifically define a temperature, feed purity and other necessary information for one skilled in the art. Examples 1 and 2 and Comparative Examples 1 and 2 as summarized in Table 3 of the specification detail an operating temperature (515°F - 520°F) and a specific pressure and space velocity for each example. Furthermore, the feedstock is noted as pure 1-butene diluted with an inert. Moreover, as illustrated by the Figures, one skilled in the art can actually measure the rate of conversion loss associated with the specifics of each example.

It is the function of the descriptive portion of the specification and not that of the claims to set forth operable proportions and similar process parameters, and claims are not rendered indefinite by absence of recitation of such limitations. *Ex parte Jackson, Theriault, Sinclair, Fager, and Karwowski*, 217 USPQ 804, 806 (Bd. App. 1982). Accordingly, there is no basis for this rejection. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 20-36 are rejected under 35 U.S.C. §112 first paragraph. The Office Action argues that the amendment made to claims 20 and the recitations of newly added claims 24 (specifically, the term “consisting essentially of”) are not disclosed in the specification. The amendment to claim 20 further specified that the components of a first intermediate feed stream include 1-butene, 2-butene and isobutylene. As explained in the specification at pages 5-6, and illustrated in FIG. 1, a C₄ feed is sent to a catalytic hydrogenation unit 11 wherein butadiene is hydrogenated to produce an intermediate stream 12 containing 1-butene, 2-butene, isobutene and a small amount of other components. The stream 12 is then sent to a unit 13 for hydroisomerization and fractionation to convert 1-butene to 2-butene and to remove isobutylene (isobutene). Referring now to page 8 of the specification and FIG. 2, the 2-butene stream is then sent olefin isomerization unit 23 as feed F. All of the recitations of claim 20 as amended are fully supported by the specification.

Regarding claim 24, the recitation of an activated catalyst consisting essentially of a basic metal oxide is fully supported by the specification. Throughout the specification the catalyst is described in terms of its purity. See e.g., page 10 lines 9 to page 11 line 8. Examples 1 and 2 employ high purity magnesium oxide. The catalyst, therefore, “consists essentially of” the basic metal oxide.

Accordingly, the amendments to claim 20 and the recitations of claim 24 are fully supported by the specification. Reconsideration and withdrawal of the rejection are respectfully requested.

2. Claims 1-23 are rejected under 35 U.S.C. §112 second paragraph.

In particular, the Office Action states that in claims 1 and 20 it is unclear which material is considered as the “activity-affecting” impurity.

As stated above, claims are to be construed in light of the specification. The purpose of a claim is not to explain technology or how it works. The claim is not indefinite if a person with ordinary skill in the art, viewing the claim in the light of the specification, would understand the scope and meaning of the claim. *S3 Inc. v. nVIDIA Corp.*, 59 USPQ2d 1745, 1748 (Fed. Cir. 2001). The specification defines activity-affecting impurities as those which adversely affect the activity of the basic metal oxide catalyst and identifies various activity-affecting impurities at page 10 lines 9-22, for example, sulfur compounds and (e.g., sulfides, sulfates), phosphorous compounds (e.g., phosphates), transition metals (e.g. oxides of iron, chromium, cobalt and nickel). One skilled in the art, upon reading applicants’ specification would not find the term “activity-affecting” impurity to be unclear.

The Office Action suggests amending the claims to explicitly recite the specific activity affecting impurities. However, specific activity affecting impurities and/or their amounts are explicitly recited in claims 4-7, 15-19, 21-23, and 27-31. Yet no indication is given in the Office Action that these claims have avoided this rejection.

Also regarding claims 1 and 20, the recitation of “that amount” is alleged to be unclear. To the contrary, one skilled in the art would readily understand that the catalyst recited in the claims contains no more activity affecting impurity than would result in a reduction of catalyst activity by about 0.075 percent conversion loss per hour. Claim 1 further specifies that this conversion loss per hour is measured by the isomerization of 1-butene to 2-butene. For example, see applicant’s specification at page 10, line 9 to page 11 line 16. Applicants have provided a

guideline and examples sufficient for determining the scope and meaning of the language of the claims.

The office action states that it is unclear if claim 12 should depend from claim 10 or 11. Claim 12 has previously been amended to depend from claim 11 rather than claim 10.

Regarding claims 13 and 14, the phrase “olefin isomerization conditions” as recited in claim 1 and to which claims 13 and 14 refer, applies to “contacting a fluid feed stream containing an olefin with an activated basic metal oxide catalyst” as per the claimed invention. Moreover, claim 1 is amended to further clarify that the isomerization of 1-butene to 2-butene is considered under the isomerization conditions.

The office action alleges that claim 16 is nonsense since claim 1 does not recite the presence of transition metals. Actually, claim 16 depends from claim 15, which does recite “at least one transition metal.” Moreover, transition metal oxides are noted as activity-affecting impurities. Iron, chromium cobalt and nickel oxides are identified as activity-affecting transition metal oxide impurities. Applicants’ specification, page 10, lines 17-22.

Regarding the statement in the final Office Action that in claim 20 “the C₄ stream” is indefinite, claim 20 has previously been amended for purposes of clarification.

Reconsideration and withdrawal of the rejection are respectfully requested.

The Rejections Under Prior Art

1. Claims 1-19 and 24-36 are rejected under 35 U.S.C. §103(a) as being obvious over Drake et al. U.S. Patent No. 4,889,840 (“Drake et al.”).

Drake et al. discloses a catalyst composition useful for olefin isomerization and disproportionation. Drake et al. mentions nothing about the importance of catalyst purity or its effect upon the ability of the catalyst to maintain its activity over time.

Drake discloses that double bond isomerization catalysts can be obtained when high surface area, high pore volume alumina is impregnated with at least one magnesium compound, which is then at least partly converted into oxide form. (Drake, col. 2 lines 22-39.) However, it is well known to those with skill in the art that alumina as a support acts as an acidic catalyst. Most-aluminas contain silica impurities that create acid sites specifically desired for cracking. The use of alumina teaches away from low acid sites, which is a feature of the present invention. Drake is silent regarding the purity of the support and the requirements for minimizing acid sites.

Claim 1 recites, inter alia, an activated basic metal oxide catalyst having an initial activity for olefin isomerization and containing an amount of activity-affecting impurity which does not exceed that amount which will result in a reduction of catalyst activity by about 0.075 percent conversion loss per hour as measured by the isomerization of 1-butene to 2-butene. Drake et al. discloses that suitable compounds for use as sources for magnesium oxide include magnesium carbonate and magnesium hydroxide. (Col. 3, lines 59-60). However, referring to applicants' specification at page 10, lines 1 to 8, and page 13, line 19 to page 14, line 1, it can be seen that these compounds are activity-affecting impurities and require a high temperature activation step to remove their presence from the catalyst. Moreover, Drake et al. teaches the use of sulfates and sulfide as precursor compounds for forming oxides of magnesium, alkali, metal, and/or zirconium. (Col. 3, lines 54-57). In contrast to this, applicants teach that sulfur is an activity-

affecting impurity, the presence of which should be minimized to at least the extent set forth in applicants' claims.

While it is true that Drake et al. teaches the conversion of metal sulfates and sulfides to the oxide form of the metals, nowhere does this patent indicate the level of purity of the final catalyst, which is a critical feature of the invention claimed herein. Nor does Drake disclose a conversion loss per hour of 0.075 percent or less.

Dependent claim 4 specifically recites that the activity-affecting impurity is, or contains, sulfur, phosphorous or a transition metal. As mentioned above, Drake et al. teaches that one can start with a precursor containing sulfur and mentions nothing about the purity of the final product. One skilled in the art would not find any suggestion in Drake et al. to use a catalyst having the impurity level below that indicated in applicants' claim 1 or especially in claims 6-8 and 18-19¹. Applicants respectfully submit that a prima facie case for obviousness is not supported by the Drake et al. reference. But applicants have also provided experimental results which rebut any inference of obviousness.

Referring now to pages 14-18 of the specification and FIGS. 4 - 6 of the drawings, and particularly to Table 3 at page 18, which summarizes the experimented results, it is shown that the catalyst of the present invention allows double bond isomerization to be performed with a deactivation rate of 0.033% (Sample A) and 0.027% (Sample B) of conversion loss per hour of on stream time, as opposed to 0.281% (Sample C) and 0.373% (Sample D) for catalysts using commercial magnesium oxide. Nothing in Drake et al. suggests the superior results achieved by applicants' catalyst and process.

¹ The maximum transition metal content of the catalyst as recited in claims 6-8 and 18-19 is 500 ppm, 400 ppm, and 330 ppm, respectively.

The Office Action argues that experimental results are not comparable to the claimed process, i.e. that the claim is broader than the single composition tested. However, the experimental results clearly show the unexpected reduction in conversion loss per hour achieved by using a high purity catalyst, which was nowhere suggested by the cited reference. Moreover, claims 3 and 26 specifically recited magnesium oxide as the catalyst, which was the basic metal oxide tested in the Examples. The Office Action did not take into consideration the separate patentability of these claims.

Regarding Drake et al., the Office Action states:

The reference appears to be silent as the conversion of the process (see the entire patent for details). However, it is known that the conversion is a parameter in a chemical process which must be selected to optimize the desired product. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the prior art process by selecting an appropriate conversion since it is expected that using any conversion yield similar results.

To the contrary, what the claims recite is “conversion loss per hour” not merely conversion. As stated in applicants’ specification, the duration of catalyst activity is a significant factor with respect to the economic viability of a process. The more often a process has to be interrupted for catalyst regeneration, the more costly the process becomes. Hence, a method for maintaining peak catalyst activity over a longer period of time is a significant advantage. See, applicants’ specification at page 2, lines 12-18. Applicants have found that reducing the level of impurities is a significant factor for maintaining the catalyst activity over a longer period of time. The data presented in the examples showing a reduction of the conversion loss per hour indicates

how effective applicants claimed process is. Nothing in the prior art suggests that such a reduction in conversion loss per hour can be achieved by basic metal oxides of high purity.

Claims 1-19 and 24-36 are submitted to be allowable over the cited reference.

Reconsideration and withdrawal of the rejection of claims 1-19 and 24-36 under 35 U.S.C. 103(a) are respectfully requested.

2. Claims 20-23 are rejected as being obvious over Drake et al. in view of U.S. Patent No. 5,087,780 ("Arganbright").

Arganbright discloses a process for hydroisomerization of butenes in a mixed hydrocarbon stream. The Office Action states:

Drake does not disclose that using a feed containing isobutene, butene-1 and -2, and butadiene which is pretreated to selectively hydrogenate butadiene, hydroisomerization of butene-1 to butene-2 and fractionation of isobutylene. However, Arganbright discloses a process [which] has steps substantially the same to produce a 2-butene stream which may [be] used for feed to an alkylation unit (see the abstract; col. 4, line 51 thru 51 col. 8, the last line).

Claim 20 has previously been amended to further specify the components of the intermediate streams in applicants' process.

Applicants' feed comprises butadiene, 1-butene, 2-butene and isobutylene. The feed is first selectively hydrogenated to convert butadiene and provide a first intermediate C₄ stream containing 1-butene, 2-butene and isobutylene. This first intermediate stream is then simultaneously hydro-isomerized to convert 1-butene to 2-butene, and fractionated to remove isobutylene. This maximizes both the production of 2-butene and simultaneously removes any

isobutylene. Thereafter, the 2-butene is converted to 1-butene using the separate double bond isomerization process and catalyst of the invention.

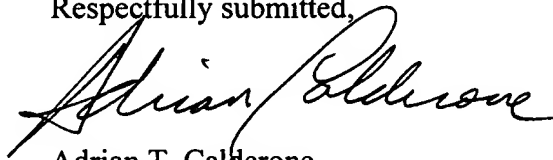
Arganbright uses a single unit to hydrogenate butadiene to butenes and immediately remove 1-butene by distillation to drive the equilibrium towards the production of 1-butene. See, Arganbright col. 4, lines 51-69. There is no equivalent of applicants step (c) of simultaneously hydroisomerizing the first intermediate stream (1-butene, 2-butene and isobutylene) to remove isobutylene and convert at least some of the 1-butene to 2-butene. Furthermore, there is no mention of a separate step of contacting the second intermediate C₄ stream (2-butene) with the claimed basic metal oxide catalyst under isomerizing conditions as recited (d) of claim 20.

The Drake et al reference is deficient for the reasons stated above. Arganbright provides no disclosure which would make up for the deficiencies of Drake et al. Accordingly, reconsideration and withdrawal of the rejection of claims 20-23 under 35 U.S.C. § 103(a) are respectfully requested.

CONCLUSION

For at least the reasons stated above, all of the pending claims are submitted to be patentable and in condition for allowance, the same being respectfully solicited.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Adrian T. Calderone", written in a cursive style.

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